State of California

THE RESOURCES AGENCY

Department of Water Resources

BULLETIN No. 119-10

FEASIBILITY OF SERVING THE HACIENDA WATER DISTRICT FROM THE STATE WATER PROJECT

OCTOBER 1964

HUGO FISHER
Administrator
The Resources Agency

EDMUND G. BROWN
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FOREWORD

In November 1960, the California Water Resources Development Bond Act was approved by the State's electorate, paving the way for the construction of the State Water Project as the first phase of the California Water Plan. Since that time, many local water service agencies throughout the State have contracted with the State for water service from the proposed facilities. Several water agencies have been organized since November 1960 expressly for the purpose of obtaining water supplies from the state facilities for the areas they represent.

Prior to executing water supply contracts with water agencies, the Department of Water Resources makes studies of the agencies and the areas encompassed by them to determine the propriety of entering into such contracts. These studies are made with the goal of evaluating (1) each area's future demand for supplemental water supplies, (2) the legal ability of each agency in question to enter into a water supply contract with the State, (3) the engineering feasibility of providing the proposed water service, and (4) the financial ability of the agency to contract for a water supply from the State Water Project.

The results of studies made for each agency, as described above, along with significant supporting material, are embodied in reports published by the Department of Water Resources. This bulletin is one of a series of such publications and describes studies which led to the signing of a contract with the Hacienda

Water District on December 20, 1963. The contract provides for delivery of a maximum annual entitlement of 8,500 acre-feet of water from the California Aqueduct.

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HUGO FISHER, Administrator, The Resources Agency
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CHAPTER I. INTRODUCTION

A contract between the State of California, Department of Water Resources, and the Hacienda Water District for a maximum annual entitlement of 8,500 acre-feet of water from the State Water Project was signed on December 20, 1963. Presented in this report are data which demonstrate the need for and feasibility of the contract. The contract includes an option to contract for a share of the project yield uncontracted on December 31, 1963.

This chapter describes the history, economy, powers, and service area of the district. Also included is a statement concerning the water supply available to the San Joaquin Valley from the State Water Project. In the following chapters there are presented discussions of the potential water demand, the cost of water service from the State Water Project, and the demand for project water as limited by cost of water. The report is concluded with an analysis of the financial feasibility of the district's purchasing water from the State.

In the course of contract negotiations with the district, there were available for consideration the Department of Water Resources' office report "Supplement to Information and Data on Proposed Program for Financing and Constructing State Water Facilities" dated May 1960 and the department's Bulletin No. 3, "The California Water Plan." These reports provided the bases for negotiations, along with the prototype water supply contract between the State and the Metropolitan Water District of Southern California; the "Standard Provisions for Water Supply Contract"

approved August 3, 1962; and Bulletin No. 132-63, "The California State Water Project in 1963."

The Hacienda Water District

The Hacienda Water District was formed under the California Water District Law. The formation of the district was approved by the voters February 11, 1958, and the Kings County Board of Supervisors declared the district formed on February 24, 1958.

The California Water District Law is contained in Division 13, Sections 34000 through 38501, of the California Water Code. The code describes district powers and duties, and prescribes the procedures for district formation, organization, management, and financing.

Powers of the District

General. The district may acquire, construct, and operate works necessary to provide water and related drainage and reclamation (Section 35401), and also works for sewage disposal (Section 35500). Portions of the territory within the district may be formed into improvement districts (Sections 36410, 36450) or distribution districts (Section 36460) to bear the costs of certain works benefiting only those areas. Only landowners may vote in district elections (Section 34027), on the basis of one vote for each dollar of assessed valuation (Section 35003).

Contracts. The district may enter into such contracts as are necessary to carry out the purposes of the district (Section 35406). The district is given specific authority to

contract with the State for the purpose of developing water supplies (Section 35851). (Contracts entered into pursuant to Section 35851 must be approved by the California Districts Securities Commission (Section 35854).) The district is also empowered to contract for water from the State Water Project by provisions of the Central Valley Project Act (see Water Code Sections 11102, 11625, 11661, and 11662).

Fiscal Powers. The district may obtain funds by water charges (Section 35470) and by ad valorem assessment of land, exclusive of improvements and mineral, oil, and gas rights (Section 36550 et seq., Section 37200 et seq.). Subject to varying restrictions, funds may be raised within an improvement district by water charges (Sections 23800 et seq., 36451), assessment according to benefits (Sections 23626, 36451), or ad valorem assessment (Sections 23532, 36452); and within a distribution district by water charges (Section 36522) or by assessment according to benefits (Section 36471). The district may issue both general obligation and revenue bonds (Section 35950 et seq.). The issuance of general obligation bonds must be approved by a two-thirds vote and revenue bonds by a majority vote (Section 35155). The district may incur a short-term debt (by issuing warrants payable at a future time) without holding an election (Section 36400). General obligation bonds (Section 36151) and warrants (Section 36408) must be authorized by the California Districts Securities Commission. General obligation bonds (Sections 23913, 36423, 36451) or warrants (Sections 23975, 36451) of the district for an improvement district may also be issued.

The District's Service Area

The service area of the Hacienda Water District consists of 15,316 acres, or the entire district, which comprises essentially the Hacienda Ranch. The district is located in southern Kings County as shown on Plate 1, "Location of Hacienda Water District." The district, as is shown on Plate 2, "Hacienda Water District," is on the lower reach of the Kern River channel to the Tulare Lake Bed (presently farmed) and includes an isolated portion of the Tulare Lake Basin Water Storage District which lies generally to the north of Hacienda Water District. The district is bounded in part on the north by the Tulare Lake Basin Water Storage District and on the west by the Dudley Ridge Water District.

The land of the district is flat and smooth except for a sand ridge across the center of the district from east to west. The average elevation in the district is approximately 210 feet.

During the five years prior to 1963, cotton, barley, seed alfalfa, safflower, and irrigated pasture were grown in the district. Cotton and barley were the dominant crops. Presently, about 3,470 acres are irrigated according to district estimates. The overlapping portion of the Tulare Lake Basin Water Storage District comprises approximately 3,100 acres which receive their water supply from the Kings River through the Homeland Canal Extension and from ground water. The remainder of the irrigated land is supplied by ground water. Under terms of existing agreements the district will get water from the Kern River in extremely wet years. Dry farming in the district is practically non-exis-

tent because of the arid climate; however, livestock grazing has been practiced during the winter and spring months for many years.

The economy of the district is based on irrigated agriculture and livestock grazing. At present there is no urban development in the district. It is anticipated that the purchase of water from the State will allow further development of irrigated agriculture and will enhance the economy of the district; however, future urban development within the district is not likely.

The climate of the region encompassing the district is characterized by hot dry summers and cool winters with low annual rainfall. Although no climatological data have been published for locations in the district, the following characteristics have been estimated from records from the Kettleman Station and Angiola Weather Bureau Stations. The average rainfall in the district is about 6.0 inches. Precipitation occurs generally from November through March. In July, the hottest month, the average maximum temperature is about 100° Fahrenheit, and in January, generally the coldest month, the average minimum temperature is about 36° Fahrenheit. Ground or tule fogs are common during winter months and occasionally persist for days or weeks. Sometimes winds of high velocity occur during the late spring months.

Water Supply Available to San Joaquin Valley From State Water Project

The California Water Commission has assigned certain state applications for appropriation of water to the department for the operation of the State Water Project. The applications show that as of December 1963 the water appropriated would be used in the following service areas:

Area	Amount in Acre-feet
Feather River	210,000
North Bay	181,000
South Bay	210,000
San Joaquin Valley	1,547,000[1/]
Central Coastal	85,000
Southern California	1,917,000
Total	4,150,000

Although the above tabulation shows 4,150,000 acre-feet of water would be diverted for use in the indicated service areas, the prototype contract states that the contracted maximum annual entitlement may not in the aggregate exceed 4,000,000 acre-feet or the minimum project yield, whichever is the lesser. The term "minimum project yield" is defined in Article 1(k) of the "Standard Provisions for Water Supply Contract" and is now estimated to be 4,000,000 acre-feet.

1/ Includes 36,000 acre-feet reserved for San Joaquin Valley but not to be transferred from South Bay and Central Coastal allocations until needed, and 36,000 acre-feet transferred from North Bay and Feather River allocations to an unallocated pool held in reserve for San Joaquin Valley when and if needed and for any other area of the State if not required in the San Joaquin Valley.

As of mid-December 1963, when the water supply contract between the State and the Hacienda Water District was in the final negotiation stage, the only San Joaquin Valley contract which had been consummated was that with the Kern County Water Agency for 1,000,000 acre-feet. Other San Joaquin Valley contracts under consideration totaled 209,000 acre-feet. Thus ample water for annual entitlements was available for contracting with the district.

In addition to annual entitlements under water supply contracts, surplus water will be available from the project. The amounts of surplus water assumed to be delivered to the district on an irrigation demand schedule are shown in column 3 of Table 7, "Financial Analysis, Hacienda Water District" (bound at the end of the report).

CHAPTER II. POTENTIAL WATER DEMAND

Presented in this chapter are discussions of the factors affecting agricultural water demand and an estimate of the potential water demand in the Hacienda Water District based on a consideration of classification of land, unit water use, and market outlook, but disregarding the cost and availability of water. The latter two are considered in Chapters III and IV.

Presented first are land classification data, estimates of unit water requirements, and a discussion of market outlook. These are followed by a determination of the potential requirement for water and an analysis of the present water supply conditions. The chapter is concluded with a determination of the potential requirement for imported water calculated as the difference between the potential water requirement and the present water supply.

As stated in Chapter I, it is not likely that there will be any urban development in the district. Therefore, the entire potential demand determined herein is agricultural.

Agricultural Water Demand Factors[1/]

Classification of Land

A land classification survey was conducted by the Department of Water Resources in the San Joaquin Valley during the period 1956-61. Table 1, "Classification of Irrigable Land in Hacienda

1/ For additional information concerning these factors, see "Appendix to Final Report, General Evaluation of the Proposed Program for Financing and Constructing the State Water Resources Development System of the State of California, Department of Water Resources," October 1960, by Charles T. Main, Inc.

Water District," is based on data obtained from that survey. In addition to the 15,158 acres of irrigable land as shown in Table 1 there are 158 acres of non-irrigable land in the district.

TABLE 1

CLASSIFICATION OF IRRIGABLE LAND
IN HACIENDA WATER DISTRICT
(In gross acres)

Valley Land of Excellent Quality[1]	Valley Land of Medium Quality[2]	Valley Land of Poor Quality[3]	Sloping Land[4]	Total
4,624	4,143	6,323	68	15,158

1/ Land classified as Vs.
2/ Land classified as Vls, Vps, Vss, and Vlss.
3/ Land classified as Vpss and Vpsa.
4/ Land classified as Hls.

Note: For definitions of land classification symbols see Department of Water Resources' "Report on Proposed Belridge Water Storage District, Kern County," December 1961.

Unit Use of Applied Agricultural Water

Estimated values of unit use of applied water for crops projected in the Hacienda Water District are tabulated in Table 2, "Unit Use Values of Applied Water for Crops Projected in Hacienda Water District."

TABLE 2

UNIT USE VALUES OF APPLIED WATER FOR CROPS PROJECTED IN HACIENDA WATER DISTRICT

Crop	Acre-feet of Water per Acre of Irrigated Land
Alfalfa, seed	3.5
Barley	1.1
Cotton	3.8
Miscellaneous field	2.0
Sugar beets	2.9
Pasture	4.1

Market Outlook

In an office study entitled "Market Outlook for Selected California Crops, 1960-2020," the department estimated future demand for specialty farm products grown in California. That study was used as a guide, together with other criteria, in estimating the district's share of the total California 1990 market for specialty farm crops. This determination took into consideration historical shifts in the production of crops among different producing areas in California. The historical regional crop production shifts for the past 40 years were plotted and projected to the year 1990.

Tentative Crop Pattern

From the market outlook study for specialty crops and estimated values of 1990 crop yields, the acreage necessary to supply the market demand for specialty crops in the district was determined. A tentative crop pattern was prepared for this acreage and the remaining acreage of the district on which non-specialty crops would be grown.

On the basis of preliminary payment capacity studies it was concluded that it would be infeasible to irrigate the entire district in the near future. Specifically, valley land of poor quality was eliminated from further consideration since it is believed that overall conditions are unfavorable for profitable crop production on this land at the water cost developed in Chapter III. That this was a reasonable conclusion is substantiated by studies reported in Chapter IV which indicate that it is economically feasible to irrigate only a portion of the valley land of excellent and medium quality in the district.

The area upon which crops have been projected comprises the 3,100 acres of overlapping land of the Tulare Lake Basin Water Storage District, and an additional area of about 5,700 acres of developed land of which portions are being irrigated each year depending upon the available water supply. The 1990 tentative crop pattern in the Hacienda Water District is shown in Table 3, "Tentative Crop Pattern on Valley Land of Excellent and Medium Quality in Hacienda Water District in 1990 Based on Consideration of Land Classification and Market Outlook." The acreage shown therein is the net acreage of valley land of excellent and medium quality in the district after making reductions in the gross areas reported in the land classification table for the portions of the irrigable land that would be occupied by farm lots, highways, canals, etc.

TABLE 3

TENTATIVE CROP PATTERN ON VALLEY LAND OF EXCELLENT AND MEDIUM QUALITY IN HACIENDA WATER DISTRICT IN 1990 BASED ON CONSIDERATION OF LAND CLASSIFICATION AND MARKET OUTLOOK

Crop	Net Acres
Major Irrigation Season	
Cotton	2,350
Sugar beets	400
Miscellaneous field	1,200
Alfalfa, seed	600
Pasture	400
Minor Irrigation Season	
Barley	2,900
Barley (double cropped)	(1,300)*
Total	7,850

*Acreage included only once in the total

Potential Water Requirement

There is a potential water requirement of about 20,900 acre-feet annually for valley land of excellent and medium quality in the Hacienda Water District. This amount is the sum of the products of the crop acreages in Table 3 and the appropriate unit use values of applied water in Table 2. The determination of this quantity is based on consideration of the previously described agricultural water demand factors, but disregards the economic factor of water cost and the availability of water. The effect of water cost on demand for water is considered in

Chapter IV. No potential water requirement was determined for the poor quality land of the district.

Present Water Supply

Surface Water Supply

The principal surface water supply of the district is imported through the Homeland Canal Extension as an entitlement for the portion of the district within the Tulare Lake Basin Water Storage District. During the five-year period from 1958 through 1962, an average of 4,800 acre-feet of water per year was imported to the district from this source; however, the long-term safe yield of this supply is estimated to be about 4,000 acre-feet per year.

As stated in Chapter I, water from the Kern River is available in extremely wet years, but streamflow is intermittent and usually of short duration. Compared to the total water supply of the district, this quantity is considered negligible.

Ground Water Conditions

The district obtains about 60 percent of its present irrigation water supply from ground water sources. This water is from wells in the eastern portion of the district and in the region to the south of the district. The water is predominantly classed "injurious to unsatisfactory" for agricultural use or Class 3.[2/] Ground water in the western portion of the district is not used because of its poor quality.

2/ For classification of irrigation water, see "Appendix A to Final Report, Proposed Belridge Water Storage District, Department of Water Resources," December 1961.

It has been assumed in this analysis that local ground water will continue to be used for irrigation after a supplemental supply becomes available. Commingling of supplemental water and ground water is expected to result in water of satisfactory quality.

It is estimated that the safe yield of the local ground water supply is approximately 6,000 acre-feet per year. Safe yield of ground water is defined as that amount of water which can be withdrawn from the underground supply for an indefinite period without causing harmful results to ground water levels or quality.

Safe Yield of Present Water Supply

The total safe yield of the existing local surface and ground water supplies available to the Hacienda Water District, as described above, is estimated to be 10,000 acre-feet annually. This estimate is based on the average annual supplies and is that amount which could be consumed annually for an indefinite period of years.

Potential Requirement for Imported Water

By deducting the estimated safe yield of the present water supply from the previously determined potential water requirement, for valley land of excellent and medium quality, the potential requirement for imported water for such land in the district is determined to be about 10,900 acre-feet annually.

The Tulare Lake Basin Water Storage District has a contract with the State for a maximum annual entitlement of 110,000 acre-feet. Since about 3,100 acres of the Hacienda Water District

are included in the Tulare Lake Basin Water Storage District, the Hacienda Water District will be entitled to receive 1.682 percent or about 1,800 acre-feet of the new supply. This entitlement will provide a part of the potential requirement for imported water, and the remaining 9,100 acre-feet comprises. therefore, the potentital requirement for imported water to be obtained directly from the State Water Project.

CHAPTER III. COST OF WATER SERVICE FROM THE STATE WATER PROJECT

The cost to the Hacienda Water District for water service from the State Water Project is dependent upon the allocation to the district of its share of the costs of the project facilities for conservation and transportation plus the cost of local conveyance facilities for distribution of water. The State Water Project will be constructed by the State primarily with funds provided under terms of the California Water Resources Development Bond Act.[1/] The local conveyance facility and distribution system will be provided by the district.

Allocation of project costs is governed by the contract executed on November 4, 1960 between the State and The Metropolitan Water District of Southern California. This contract is the department's prototype water supply contract. The department's publication "Standard Provisions for Water Supply Contract" approved August 3, 1962 is based on the prototype contract.

The standard provisions set forth the terms which will be generally applicable to all contracts, and establish the mutual obligations of the State and the water supply contractors. The State's essential obligation is to make available for delivery to the contracting agency, at its delivery structures, designated amounts of project water each year, commencing with the year of initial water delivery and continuing through the life of the contract. The essential obligation of the contracting agency is to make all payments required under the contract.

1/ Chapter 8 (commencing with Section 12930) of Part 6 of Division 6 of the Water Code.

Cost of State Water

Under terms of the department's water supply contracts, each contracting agency will be charged for such quantities of project water as it is entitled to receive each year. In addition, charges will be made for surplus water which will be available to each agency under certain conditions.

Cost of Entitlement Water

Charges under the contracts are made to secure payment of reimbursable costs of the project conservation works and project transportation facilities necessary to deliver water. Charges for these purposes are called, respectively, the Delta Water Charge and the Transportation Charge.

Delta Water Charge. Every contractor for project water will pay the Delta Water Charge as an annual charge per acre-foot of project water included within its annual entitlement for the respective year. This charge, together with revenues derived from power generated in connection with the operation of project conservation facilities, will return to the State all reimbursable costs of the conservation facilities over the project repayment period.

The Delta Water Charge is established at a rate of $3.50 per acre-foot through the year 1969 and is estimated to be $5.46 per acre-foot for the period 1970 through 1977, and $7.34 per acre-foot thereafter until supplemental conservation facilities, as defined in the standard provisions, are constructed. Estimated charges for this component for the demand buildup included in the contract with the district are included in Table 4, "Summary of

TABLE 4

SUMMARY OF ANNUAL CHARGES TO HACIENDA WATER DISTRICT
FOR WATER FROM THE STATE WATER PROJECT
(In dollars unless otherwise noted)

Calendar Year	ANNUAL ENTITLEMENTS (In acre-feet)	ALLOCATED: TRANS-PORTATION: CAPITAL COSTS	TRANSPORTATION CHARGE: Capital Cost Component	Minimum OMP & R Component	Variable OMP & R Component	Total Trans-portation Charge	DELTA WATER CHARGE	TOTAL WATER CHARGES
1964	0	166,900	0	0	0	0	0	0
1965	0	174,900	0	0	0	0	0	0
1966	0	165,800	0	0	0	0	0	0
1967	0	127,000	0	800	0	800	0	800
1968	1,300	19,300	6,900	4,100	7,600	18,600	4,600	23,200
1969	1,600	2,600	8,400	4,800	8,000	21,200	5,600	26,800
1970	2,000	100	10,600	5,300	8,800	24,700	10,900	35,600
1971	2,300	7,700	12,100	5,800	8,600	26,500	12,600	39,100
1972	2,600	0	13,700	6,500	9,700	29,900	14,200	44,100
1973	2,900	0	15,300	6,500	10,800	32,600	15,800	48,400
1974	3,300	100	17,400	6,500	11,300	35,200	18,000	53,200
1975	3,600	7,700	19,000	6,500	13,400	38,900	19,700	58,600
1976	3,900	0	20,600	6,500	14,900	42,000	21,300	63,300
1977	4,200	100	22,200	6,500	16,100	44,800	22,900	67,700
1978	4,600	7,700	24,300	6,600	18,100	49,000	33,700	82,700
1979	4,900	0	25,800	6,600	19,300	51,700	36,000	87,700
1980	5,200	0	27,400	7,000	21,500	55,900	38,200	94,100
1981	5,600	0	29,500	7,000	22,800	59,300	41,100	100,400
1982	5,900	0	31,100	7,100	24,700	62,900	43,300	106,200
1983	6,200	0	32,700	7,100	25,800	65,600	45,500	111,100
1984	6,500	0	34,300	7,100	27,200	68,600	47,700	116,300
1985	6,900	2,800	36,400	7,100	28,600	72,100	50,600	122,700
1986	7,200		38,000	6,700	26,200	70,900	52,800	123,700
1987	7,500		39,600	6,700	26,700	73,000	55,000	128,000
1988	7,800		41,100	6,700	27,600	75,400	57,300	132,700
1989	8,200		43,300	6,700	28,300	78,300	60,200	138,500
1990-2035	8,500		44,800	6,600	28,800	80,200	62,400	142,600
TOTALS	495,200	682,700	2,610,500	445,800	1,730,800	4,787,100	3,577,400	8,364,500
EQUIVALENT UNIT RATES (In dollars per acre-foot)			5.28	1.10	3.64	10.02	7.02	17.04

Annual Charges to Hacienda Water District for Water From the State Water Project."

Transportation Charge. In addition to the Delta Water Charge, contractors receiving water from the State Water Project will pay for the construction and operation of the transportation facilities. Articles 23 through 28 of the standard provisions govern the determination of the transportation charge.

The allocation to each contractor of costs comprising three components of the transportation charge is made on a proportionate-use-of-facilities basis. The capital cost and the minimum or fixed operation, maintenance, power, and replacement costs are allocated on the basis of the maximum annual entitlement and peaking capacity provided for the contractor within each reach of the aqueduct which would be used to convey water to the contractor. The variable operation, maintenance, power, and replacement costs are allocated on the basis of the contractor's share of water delivered through each reach of the aqueduct during each year.

The project transportation facility that would be used to provide water to the district is the portion of the California Aqueduct from the Sacramento-San Joaquin Delta to the junction with the Coastal Aqueduct. The elevation of the water surface in the California Aqueduct is approximately 313.5 feet near Kettleman City and decreases to approximately 310 feet at the Kern County line.

The total transportation capital cost allocated to the district is estimated to be $682,700 for a maximum annual entitle-

ment of 8,500 acre-feet at a maximum monthly peaking rate of 18 percent.

Under Article 24(c) of the standard provisions, the construction or capital cost component of the transportation charge allocated each year to a contractor must be paid in 50 equal annual payments of principal and interest. Article 45 of the prototype contract, however, permits modification of such payment method within certain limitations. Payment at a unit rate per acre-foot of water delivered which will repay all costs with interest during the project repayment period is such a permissible modification and is the method of payment assumed herein. The unit rate is estimated to be $5.28 per acre-foot for the annual entitlements set forth in the district's contract. Payment at this rate commencing in the initial year of water delivery will repay all principal together with interest at the project interest rate compounded annually, of the estimated project transportation capital costs allocated to the district within the project repayment period.

Annual values for the Delta Water Charge and the components of the Transportation Charge for deliveries to the district are shown in Table 4.

The determination of charges under the contract, as described above and as summarized in Table 4, does not result in a uniform charge per acre-foot of entitlement water throughout the repayment period. Since major portions of the total charge are on a unit rate basis, however, the total charge is fairly uniform. Equivalent unit rates of components of the total charge

have been computed for the purposes of comparison. These are shown in Table 4. The equivalent unit rate is defined as that constant charge which when assessed against each acre-foot of delivery during the entire repayment period will produce an amount by the end of the period equivalent to the sum of the annual charges which would have been assessed under a water supply contract, together with interest computed at the project interest rate which is assumed to be four percent per annum. The total estimated equivalent unit rate for service of annual entitlements to the district under these assumptions is $17.04 per acre-foot at canalside as shown in Table 4.

Cost of Surplus Water

Article 21 of the standard provisions provides that if during any year the supply of project water, after appropriate allowance for holdover storage, exceeds the total annual entitlements of all contractors for that year, the State shall offer to sell and deliver such surplus water for periods expiring not later than the end of such year. The article also provides that the charge for surplus water shall be at least equal to the variable operation, maintenance, and power costs incurred in service of such water. This would include variable charges for both the conservation and transportation facilities.

Under a modification of Article 21 in the contract negotiated with the district, surplus water would be allocable to the district for agricultural and ground water replenishment use on the basis of the amount of entitlement water it so uses.2/

2/ Article 45(a) of contract between Hacienda Water District and the State dated December 20, 1963.

Such surplus water would be furnished at prices which would return to the State the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge incurred in the service of such water. Contracts made pursuant to such modification of Article 21 may exceed one year in duration.

The unit rate for surplus water which could be supplied for agricultural and ground water replenishment use in Kings County is estimated to range from $3 to $4 per acre-foot. It is estimated that surplus water will be available to the district on an irrigation demand schedule through 1981. The equivalent unit rate for delivery of combined project water to meet annual entitlements and surplus water is about $15.10 per acre-foot over the repayment period for the contracted annual entitlements shown in column 2 and the assumed deliveries of surplus water in column 3 of Table 7.

Surcharge

A surcharge equivalent to the power credit per acre-foot of water will be made for project water put to agricultural or manufacturing use on excess land. This surcharge is provided for in Article 30 of the standard contract provisions, and is established as $2 per acre-foot until all of the facilities for generation of electrical energy in connection with the operation of initial project conservation facilities are installed and in operation. Each year thereafter the State will redetermine the power credit per acre-foot of water. Excess land is defined as that part of any land in excess of 160 acres in single beneficial

ownership, or 320 acres in joint ownership by husband and wife. The surcharge would be applicable to project water delivered under the district's annual entitlement and to surplus water.

Surcharge Credit

Under terms of San Joaquin Valley agricultural contracts, the State may allow a credit to the contractor not to exceed the surcharge to be paid by such contractor, which credit shall be utilized to reduce the cost of water for agricultural use on other than excess land at a uniform rate not to exceed $2 per acre-foot.3/

Cost of Local Distribution

An extensive irrigation system of unlined canals and ditches has been developed and is used satisfactorily in the Hacienda Water District. With slight improvement this system can be utilized by the district for distribution of project water to be delivered from the California Aqueduct.

A locally constructed and financed conveyance facility will be required to convey water from the California Aqueduct to the district. The district lies at a lower elevation than the aqueduct, and that point of the district which lies closest to the aqueduct is six miles east of it.

Preliminary designs of two alternative conveyance facilities have been made for purposes of estimating costs for conveying water from the California Aqueduct to the district. The first facility would serve only the Hacienda Water District. The second would be used jointly with the Tulare Lake Basin Water Storage

3/ Article 45(b) of the contract between Hacienda Water District and the State dated December 20, 1963.

District. These facilities would provide capacity to divert 18 percent of the district's contracted maximum annual entitlement in a one-month period.

In the conveyance facility considered for sole use by the district, the turnout structure from the California Aqueduct would be located three and one-half miles south of the junction of the California Aqueduct and Coastal Aqueduct. From this point a gravity conduit consisting of concrete pressure pipe and lined canal would cross the Dudley Ridge Water District in an easterly direction for approximately seven and one-half miles to the western boundary of the Hacienda Water District. The canal would then follow Sand Ridge through the district and terminate at the Hacienda Spillway.

In the joint-use facility, the turnout structure from the California Aqueduct would be located one mile north of the junction of the California Aqueduct and Coastal Aqueduct. From this point a gravity conduit consisting of lined and unlined canals would cross the Dudley Ridge Water District in an easterly direction for approximately eight miles to the existing Liberty Farms South Canal, through which water would be delivered to the district.

Cost estimates of construction of the conveyance facilities are based on unit cost data adjusted to reflect 1962 prices. Table 5, "Costs of Alternative Conveyance Facilities for Hacienda Water District," presents the costs of the two facilities considered. It has been assumed the capital cost would be repaid by the end of a 40-year period commencing in 1968. From then on, the total annual cost would include only the operation, maintenance, and replacement charges.

TABLE 5

COSTS OF ALTERNATIVE CONVEYANCE FACILITIES
FOR HACIENDA WATER DISTRICT

	District Facility	Joint Facility
Capital Cost	$ 530,000	$ 86,200
Annual Costs		
Debt Service @ 5% for 40 years	30,900	5,000
O.M.&R.	3,400	600
TOTAL ANNUAL COST	34,300	5,600

In addition to the costs shown in Table 5, there will be operation, maintenance, and replacement costs of $1.33 per acre-foot for the existing distribution system. This cost will be about $11,400 per year when the maximum delivery of 8,500 acre-feet per year is made. The cost of improvements to this system have not been included, since the cost is considered to be negligible.

The above annual cost does not include the estimated capital cost for a turnout structure which must be paid to the State prior to its construction. The district's cost for the turnout structure would be about $20,000 for the district-owned conveyance facility and $11,500 for the joint-use facility.

It has been assumed in the financial analysis of Chapter V that the district would utilize the joint-use conveyance facility and that the expenditure for the conveyance facility would occur in 1967. The total cost, including the capital cost of the conveyance facility and the operation, maintenance, and replacement charges of both the distribution system and the conveyance facility, on an equivalent unit rate basis, is $2.22

per acre-foot over the 40-year repayment period or $2.10 per acre-foot over the 68-year State Water Project repayment period. The latter amount consists of $0.68 per acre-foot for repayment of the capital cost and $1.42 per acre-foot for operation, maintenance, administration, and replacement costs.

CHAPTER IV. DEMAND FOR PROJECT WATER

Presented in this chapter are the relevant economic factors and data used to determine project water demand, an estimate of the demand, and a determination of the buildup of demand in the Hacienda Water District. The purpose of studying these matters was to determine to what extent the farming of land in the district could support the purchase of the "potential requirement for imported water" which was developed in Chapter II.

Payment Capacity of Crops

In this report, payment capacity is defined as the amount which is available from gross crop revenues to pay water costs after deducting all other farm production expenses. The appraisal of crop payment capacity per acre-foot of water involves the consideration of crop yields, prices received, crop production costs, and other factors related thereto. These factors are briefly discussed, and a payment capacity determination is presented, in the following paragraphs.

Crop Yields

Crop yields used in this payment capacity analysis were developed following review of Kings County agricultural reports and conferences with local authorities. The adopted yields are believed to be conservative.

Prices Received

The prices of farm products used in this analysis are essentially the averages of prices received by Kings County farmers

during the 1952-56 period. This information was obtained from Agricultural Commissioner's reports and conferences with local authorities.

Crop Production Costs

Crop production costs are computed on a per acre basis, using the estimated average unit prices paid during the 1952-56 period for the factors of production, including interest, taxes, and wages. These unit prices are applied to all labor and materials, except water, used in production; cash overhead, such as taxes, repairs, and general expenses; all interest and depreciation; and management charges.

In addition to the foregoing there is included in the crop production costs an allowance for occasional losses attributable to inclement weather and adverse market conditions.

Drainage

Nearly all of the Hacienda Water District is underlain by basin deposits of silt and clay, which have low permeability to water. There is a drainage problem arising from the irrigation of land presently under cultivation. It is suspected that this problem will be aggravated with the additional application of irrigation water under project conditions. A possible remedial measure to alleviate the drainage problem would be to install open-ditch or tile drains. The cost of providing such drains is not included in the crop production costs used herein, but it is believed the district could provide adequate drainage facilities during the early critical years of the project repayment period at

a cost which would not significantly affect the conclusions reached herein.

Payment Capacity Determination

Estimated crop production costs on a per acre basis, excluding cost of water, for each of the projected crops shown in Table 3 were deducted from gross income values, derived from crop yields and prices received, to establish the payment capacity per acre of each crop. Payment capacities at the farm headgate for crops in the district are shown in Table 6, "Water Demand Schedule for Valley Land of Excellent and Medium Quality in Hacienda Water District."

Most of the data used in the payment capacity determination have been derived from the department's office report entitled "Supplement to Information and Data on Proposed Program for Financing and Constructing State Water Facilities" dated May 1960.

Economic Demand for Water

In this report a water demand schedule is defined as a catalogue of quantities of water that will be purchased at various possible prices at a given time. Such a schedule indicates the relationship of demand for water to cost of water and is presented here in tabular form as a water cost-demand curve.

A water demand schedule is based on the principle that as the price of water decreases the demand for water increases and, conversely, as the price increases the demand decreases. This difference in demand occurs because different crops possess different abilities to pay for water, different lands have different abilities to grow crops, and operators with sunk investments

TABLE 6

WATER DEMAND SCHEDULE
FOR VALLEY LAND OF EXCELLENT AND MEDIUM QUALITY
IN HACIENDA WATER DISTRICT

Crop	Land Class	Projected Crop Acreage in 1990 on Presently Developed Land (In acres)	Water Requirement (In acre-feet per acre)	Water Requirement (In acre-feet)	Payment Capacity Per Acre-foot	Cumulative Water Requirement (In acre-feet)
Cotton	Excellent	1,250	3.8	4,700	$ 33.40	4,700
Sugar beets	Excellent	210	2.9	600	31.40	5,300
Miscellaneous field	Excellent	620	2.0	1,200	26.00	6,500
Barley	Excellent	2,230	1.1	2,500	24.50	9,000
Cotton	Medium	1,100	3.8	4,200	21.60	13,200
Miscellaneous field	Medium	580	2.0	1,200	19.50	14,400
Sugar beets	Medium	190	2.9	600	17.60	15,000
Barley	Medium	1,970	1.1	2,200	16.40	17,200
Alfalfa, seed	Excellent	320	3.5	1,100	11.70	18,300
Pasture	Excellent	400	4.1	1,600	9.80	19,900
Alfalfa, seed	Medium	280	3.5	1,000	9.70	20,900
TOTALS		9,150*		20,900		

* Includes 1,300 acres of double cropped land.

vary from other operators in their willingness to pay for water. Some crops, such as sugar beets and cotton, have greater ability to pay for water than crops such as grain and miscellaneous field crops. Farm operators will normally only grow those crops which, as a minimum, return all the variable costs of production. Consequently, with high-cost water only the crops with higher payment capacities would be grown, but with low-cost water a larger amount of water would be purchased to irrigate crops with both high and low payment capacities.

The payment capacities of the various crops tentatively projected on land of excellent and medium quality have been arrayed by magnitude in Table 6. Values in this table were used to plot the curve shown on Plate 3, "Irrigation Water Cost-Demand Curve for Hacienda Water District."

The weighted average unit cost of the present irrigation supply and the future supply of state water has been determined for the purpose of utilizing the water cost-demand curve. It has been assumed that Kings River water would cost $4.25 per acre-foot, ground water would cost $5.00 per acre-foot, and the district would charge the rates for water from the State shown in columns 5 and 7 of Table 7 (bound at the end of the report). These rates for state water average about $17 per acre-foot, for delivery of water to farm headgates. It is assumed that the 1,800 acre-feet of water to be obtained through the Tulare Lake Basin Water Storage District, as described in Chapter II, will also be available at the rate

of $17 per acre-foot. The weighted average unit cost for 4,000 acre-feet of Kings River water, 6,000 acre-feet of ground water, and 10,900 acre-feet of water from the California Aqueduct is $11.11 per acre-foot. With this water cost, the irrigation water cost-demand curve indicates there would be an economic demand for about 19,000 acre-feet of water.

The water cost-demand curve is based on a consideration of the payment capacity of each crop alone, with no allowance for averaging among crops. Theoretically, for a given cost of water, only those crops and land combinations would be utilized which have payment capacities greater than the cost of water. It is believed, however, that within a farm unit, there will be some averaging; that is, the owner will to some extent utilize the excess of payment capacity over cost of some crops to assist in the purchase of water for crops with payments capacities less than water costs. The growing of the latter crops is desirable for crop rotation purposes. For this reason, it is believed that the economic demand for water in the district will be approximately equal to the district's potential water requirement of 20,900 acre-feet per year for valley land of excellent and medium quality.

The economic demand could be supplied as follows: 4,000 acre-feet from the Kings River, 6,000 acre-feet from ground water, 1,800 acre-feet from Tulare Lake Basin Water Storage District under its new contract, and the remainder of 9,100 acre-feet from the State Water Project by direct contract. Thus, the estimated 1990 economic demand in the district for water which could be obtained by direct contract with the State totals 9,100 acre-feet.

Water Demand Buildup

The department's projected rate of water demand buildup in the district is based on the estimated future market demand for crops. The rate of demand buildup requested by the district and subsequently contracted for was approximately that proposed by the department. Therefore, in this report the district's request for annual entitlements has been used. The projected rate of demand buildup for annual entitlements of project water to the 1990 quantity is presented in column 2 of Table 7. The amounts of surplus water assumed to be delivered on an irrigation demand schedule are shown in column 3 of Table 7.

CHAPTER V. FINANCIAL FEASIBILITY

The previous chapter indicates there is an estimated economic demand for 9,100 acre-feet of state water in addition to the 1,800 acre-feet from Tulare Lake Basin Water Storage District to irrigate land in the Hacienda Water District. As previously indicated the district has contracted for a maximum annual entitlement of 8,500 acre-feet. Presented in this chapter is an analysis which demonstrates the feasibility of a plan for the repayment by the district of the long-term debt which must be undertaken in order to purchase water under the contract and deliver the water to the users' headgates.

Although the cost of the water to the district will be relatively high, it is shown in Table 7, "Financial Analysis, Hacienda Water District," that the district will not be unduly burdened by its debt incurred for purchase, conveyance, and distribution of water during the project repayment period.

The analysis indicates that the district can meet, on a year-to-year basis, the cost of project water and the cost of conveyance and distribution facilities to get water to the land. It is believed that the information presented herein justifies the contract between the State and the district.

Financial Analysis

The various factors entering into the financial analysis are discussed in the following paragraphs. The analysis is presented in Table 7 which appears at the end of the report.

Water Toll

A water toll method of recovering water costs has been utilized in this analysis. Assumed district water tolls for annual entitlements and surplus water are shown in columns 5 and 7 of Table 7. During the period 1968 through 1971, a toll of $19.00 per acre-foot has been assumed to recover all costs, including the cost of the turnout structure and measuring device, and to provide excess revenue to insure against deficit spending in 1972, when surplus water is not expected to be available.

For the periods 1972 through 1979 and 1980 through 1988, tolls of $16.00 and $15.00 per acre-foot, respectively, have been assumed. These tolls will allow total revenues to equal total costs by the end of 1989. For the remainder of the repayment period the assumed tolls will balance costs on a year-to-year basis. It will be noted in the analysis that no revenue from the sale of surplus water is assumed after 1981. Some surplus water would probably be available at off-peak times after that year, but it is assumed it would be sold at or near cost. Costs and tolls would therefore remain in balance.

Assessed Valuation and Bonded Indebtedness

The 1963-64 assessed valuation of the district is $176,550. The bonded indebtedness assignable to the district's area was $4,640 as of June 30, 1963. The bonded indebtedness is thus 2.6 percent of the assessed valuation.

Financial Analysis Table

Presented in Table 7 is a year-by-year summary of the

assumed revenues from sale of water by the district; the costs which would be charged to the district by the State for annual entitlements and surplus water; the costs which would be incurred by the district for conveyance and distribution of state water; the difference between revenues and costs or the net operating revenues; and the calculation of balance of funds remaining at the end of the year.

The capital cost for the turnout structure and measuring device from the California Aqueduct must be paid prior to the start of construction. It is estimated that the district's share of the cost of a joint turnout structure will be $11,500, which will be due in 1966. In this analysis, it has been assumed that the district would pay this cost in a lump sum financed from a short-term loan.

During the early years of the project, substantial amounts of revenue in excess of cost are generated. These excess revenues accumulate in 1980 to a maximum of $211,700, including interest at four percent. Thereafter, the year-end balance is reduced to zero by 1989 and remains so throughout the repayment period.

Although the net revenues are assumed to accumulate interest during the early years of the project, these funds could be used to finance partially the construction of the conveyance facility and/or make advance payments to the State. The latter would be equivalent to investment of the net revenues at four percent if the project interest rate, which is dependent upon the

interest rate on bonds sold by the State, averages four percent as was assumed in making the estimates of water cost.

The financial analysis contains many assumptions as to matters which are in the province of the Board of Directors of the Hacienda Water District. It is believed, however, that the assumptions employed herein are sufficiently representative to demonstrate that not only is the suggested program financially feasible, but that it would remain so with reasonable variation in the assumptions.

An explanation of the column headings of the financial analysis table follows:

Explanation of Column Headings in Table 7

Column Number	Comments
1	Years of the period of analysis commencing in year 1966, the year in which payment for the turnout structure is assumed to be made, and terminating in 2035, the assumed end of the 50-year repayment period following final project construction.
2	Delivery of annual entitlement water. The total demand and the rate of demand buildup are those negotiated by the department and the district, and which appear in Table A of the contract between the district and the State.
3	Annual delivery of surplus water on an irrigation demand schedule. Its use terminates after 1981, the estimated last year of availability of such surplus water.

Explanation of Column Headings in Table 7 (Continued)

Column Number	Comments
4	Total annual delivery to the district. (Sum of columns 2 and 3.)
5	Assumed tolls for entitlement water to all users in the district at farm headgate.
6	Total revenue from delivery of annual entitlements of water. (Product of columns 2 and 5.)
7	Assumed tolls for surplus water to all users in the district at farm headgate.
8	Total annual revenue from delivery of surplus water on an irrigation demand schedule. (Product of columns 3 and 7.)
9	Total annual revenue from delivery of both types of water. (Sum of columns 6 and 8.)
10	Annual repayment requirements for annual entitlements delivered at canalside to be paid to the State on a unit rate basis allowed under provisions of Article 45 of the Metropolitan Water District prototype contract.
11	Cost per acre-foot of delivering surplus water at canalside on an irrigation demand schedule.
12	Total annual cost of delivering surplus water at canalside on an irrigation demand schedule. (Product of columns 3 and 11.)
13	Total annual cost of delivering both types of water at canalside. (Sum of columns 10 and 12.)

Explanation of Column Headings in Table 7 (Continued)

Column Number	Comments
14	Total annual local conveyance and distribution costs based on peak demand of 18 percent and 40-year repayment period at five percent interest.
15	Total annual cost of delivering both types of water to the farm headgate. (Sum of columns 13 and 14.)
16	Difference between cost of delivering both types of water to the farm headgate and estimated revenue received by the district from the sale thereof. (Column 9 less column 15.)
17	Balance of available funds from previous year plus net operating revenue collected in current year. (Sum of column 19 of previous year and column 16 of current year.)
18	Interest earning on balance of district funds. (Product of .04 and column 17.)
19	Balance of funds available to district at end of each year. (Sum of columns 17 and 18.)

CHAPTER VI. SUMMARY AND CONCLUSIONS

The pertinent information presented in this report is summarized and conclusions are presented in the following sections.

Summary

1. The Hacienda Water District was formed in 1958. It comprises 15,316 acres of land in Kings County, including 3,100 acres which are also in Tulare Lake Basin Water Storage District. It may contract with the State for a water supply, construct and operate conveyance and distribution facilities to deliver said supply, and obtain funds by water charges and by ad valorem assessments of land.

2. The economy of the district is based on irrigated agriculture and livestock grazing. Presently about 3,470 acres are irrigated. It is expected that the purchase of water from the State will enhance the economy and that it will continue to be based on irrigated agriculture and livestock grazing.

3. The California Water Commission, as of December 1963, allocated 1,547,000 acre-feet of water from the State Water Project to the San Joaquin Valley, including 72,000 acre-feet reserved for the valley from other allocations if needed. At the time final negotiations of a water supply contract between the State and the district were in progress in December 1963, only 1,000,000 acre-feet of this total had been contracted for and other contracts for about 209,000 acre-feet were under negotiation. Thus ample water for annual entitlements was available for contracting with the district.

4. There is a potential water requirement of about 20,900 acre-feet annually for valley land of excellent and medium quality in the district. The determination of this quantity is based on a consideration of agricultural water demand factors, but disregards the availability and cost of water. As is indicated below, the payment capacity of crops grown in the district is sufficient only to support the growing of crops on this land. Therefore, although the valley land of poor quality is irrigable, the potential water requirement for this land has not been determined.

5. The principal surface water supply of the district is imported through the Homeland Canal Extension as an entitlement for the portion of the district within the Tulare Lake Basin Water Storage District. The long-term safe yield of this supply is estimated to be about 4,000 acre-feet per year. Water from the Kern River is available in extremely wet years, but streamflow is intermittent and usually of short duration. Compared to the total water supply of the district, this quantity is negligible.

6. The district obtains about 60 percent of its present irrigation water supply from wells in the eastern portion of the district and in the region to the south of the district. It is estimated that the safe yield of the local ground water supply is approximately 6,000 acre-feet per year.

7. The potential requirement for imported water for valley land of excellent and medium quality in the district is about 10,900 acre-feet annually.

The district is entitled to receive 1,800 acre-feet of the water supply available to Tulare Lake Basin Water Storage

District under its new contract with the State. Thus, the potential requirement for imported water to be obtained directly from the State Water Project is 9,100 acre-feet.

8. Water from the California Aqueduct can be provided to the district at an estimated equivalent unit rate for annual entitlements of $17.04 per acre-foot at canalside. The unit rate for surplus water used for agricultural purposes in Kings County is estimated to range from $3 to $4 per acre-foot. The equivalent unit rate for delivery of combined entitlement and surplus water is about $15.10 per acre-foot over the repayment period.

9. The district has a distribution system which can be used to distribute water from the California Aqueduct, and is considering the joint use of a conveyance facility with Tulare Lake Basin Water Storage District to convey water from the aqueduct to the system. The estimated total cost to convey and distribute water, including the capital cost of the conveyance facility and the operation, maintenance, and replacement charges of both the distribution system and the conveyance facility, on an equivalent unit rate basis, is $2.22 per acre-foot through the year 2007, the last year of repayment of the capital cost. The rate will then decrease to about $1.42 per acre-foot.

10. Consideration of the payment capacity of crops and the cost for purchase, conveyance, and distribution of water indicates that the economic demand in 1990 in the district will approximately equal the district's potential water requirement of 20,900 acre-feet per year for valley land of excellent and medium quality. The economic demand could be supplied as follows: 4,000 acre-feet from

the Kings River, 6,000 acre-feet from ground water, 1,800 acre-feet from Tulare Lake Basin Water Storage District, and the remainder of 9,100 acre-feet from the State Water Project by direct contract with the State. The district contracted on December 20, 1963 for a water supply of 8,500 acre-feet annually from the State Water Project.

11. The assessed valuation of the district is $176,500 based on the 1963-64 assessment. The bonded indebtedness assignable to the district's area was $4,630 as of June 30, 1963. The bonded indebtedness is thus 2.6 percent of the assessed valuation.

12. The district will not be unduly burdened by the debt incurred for purchase and distribution of water under the State contract during the project repayment period.

Conclusions

1. The State of California has the necessary water supply and the authority to enter into the contract with the Hacienda Water District, which was signed December 20, 1963 for the service of a maximum annual entitlement of 8,500 acre-feet of water, and which includes an option to increase the amount of the contract by the district's share of the project yield uncontracted on December 3 1963.

2. The contractual cost to the district and the cost for conveyance and distribution of the water can be met with agricultural water tolls which would not exceed the ability of users to pay for water.

3. The Hacienda Water District has the authority, the necessity, and the financial capability to enter into a contract

with the State of California for the service of a maximum annual entitlement of 8,500 acre-feet of water from the State Water Project.

:		:Previous Year:	:	
st:	Net	: Balance Plus:	Interest:	Balance
	:Operating:	Net Operating:	at	:at End
:	Revenue :	Revenue :	4%	:of Year
5	9-15=16	17	18	17+18=19
		$-11,500*		
0	$ -800	-800	$ -500	$-12,800
0	13,200	400	0	400
0	7,000	7,400	300	7,700
0	3,800	11,500	500	12,000
0	5,600	17,600	700	18,300
0	-11,600	6,700	300	7,000
0	23,800	30,800	1,200	32,000
0	21,300	53,300	2,100	55,400
0	34,600	90,000	3,600	93,600
0	24,200	117,800	4,700	122,500
0	13,500	136,000	5,400	141,400
0	23,200	164,600	6,600	171,200
0	19,500	190.700	7,600	198,300
0	5,300	203,600	8,100	211,700
0	-9,000	202,700	8,100	210,800
0	-31,200	179,600	7,200	186,800
0	-32,000	154,800	6,200	161,000
0	-33,000	128,000	5,100	133,100
0	-34,000	99,100	4,000	103,100
0	-30,900	72,200	2,900	75,100
0	-31,100	44,000	1,800	45,800
0	-31,700	14.100	600	14,700
0	-14,700	0	0	0
0	0	0	0	0
0	0	0	0	0

TABLE 7

FINANCIAL ANALYSIS
HACIENDA WATER DISTRICT

Year	Annual Water Deliveries (In acre-feet)			Annual Revenues					Annual Costs at Canalside				Total Annual Local Distribution & Conveyance Costs	Total Cost at Farm Headgate	Net Operating Revenue	Previous Year: Balance Plus Net Operating Revenue	Interest at 4%	Balance at End of Year
				Entitlement		Surplus			Entitlement	Surplus								
	Entitlement	Surplus	Total	Per Acre-foot	Total	Per Acre-foot	Total	Total	Total	Per Acre-foot	Total	Total						
1	2	3	2+3=4	5	2x5=6	7	3x7=8	6+8=9	10	11	3x11=12	10+12=13	14	13+14=15	9-15=16	17	18	17+18=19
1966																$-11,500*		
67									$ 800			$ 800		$ 800	$ -800	-800	$ -500	$-12,800
68	1,300	1,300	2,600	$19.00	$ 24,700	$19.00	$24,700	$ 49,400	23,200	$3.02	$ 3,900	27,100	$ 9,100	36,200	13,200	400	0	400
69	1.600	800	2,400	19.00	30,400	19.00	15,200	45,600	26,800	3.76	3,000	29,800	8,800	38,600	7,000	7,400	300	7,700
1970	2,000	700	2,700	19.00	38,000	19.00	13,300	51,300	35,600	3.80	2,700	38,300	9,200	47,500	3,800	11,500	500	12.000
71	2,300	700	3,000	19.00	43,700	19.00	13,300	57,000	39,100	3.86	2,700	41,800	9,600	51,400	5,600	17,600	700	18,300
72	2,600	0	2,600	16.00	41,600	16.00	0	41,600	44,100		0	44,100	9,100	53,200	-11,600	6,700	300	7,000
73	2,900	3,000	5,900	16.00	46,400	16.00	48,000	94,400	48,400	2.90	8,700	57,100	13,500	70,600	23,800	30,800	1,200	32,000
74	3.300	2,700	6,000	16.00	52.800	16.00	43,200	96,000	53,200	2.94	7,900	61,100	13,600	74,700	21,300	53,300	2,100	55,400
1975	3.600	4,000	7,600	16.00	57.600	16.00	64.000	121,600	58,600	3.17	12,700	71,300	15,700	87,000	34,600	90,000	3,600	93,600
76	3,900	3.100	7,000	16.00	62,400	16.00	49,600	112,000	63,300	3.05	9,500	72,800	15,000	87,800	24,200	117,800	4,700	122,500
77	4.200	2.200	6,400	16.00	67,200	16.00	35,200	102,400	67,700	3.21	7,100	74,800	14,100	88,900	13,500	136,000	5,400	141,400
78	4.600	3,900	8,500	16.00	73,600	16.00	62,400	136,000	82,700	3.37	13,100	95,800	17,000	112,800	23,200	164,600	6,600	171,200
79	4.900	3.600	8,500	16.00	78,400	16.00	57,600	136,000	87,700	3.27	11,800	99,500	17,000	116,500	19,500	190.700	7,600	198,300
1980	5.200	3,300	8,500	15.00	78,000	15.00	49,500	127,500	94,100	3.35	11,100	105,200	17,000	122,200	5,300	203,600	8,100	211,700
81	5.600	2,000	7,600	15.00	84,000	15.00	30,000	114,000	100,400	3.43	6,900	107,300	15,700	123,000	-9,000	202,700	8,100	210,800
82	5,900		5,900	15.00	88,500			88,500	106,200			106,200	13,500	119,700	-31,200	179,000	7.200	186,800
83	6.200		6.200	15.00	93,000			93,000	111,100			111,100	13,900	125,000	-32,000	154,800	6,200	161,000
84	6.500		6,500	15.00	97.500			97,500	116,300			116,300	14,200	130,500	-33,000	128,000	5,100	133,100
1985	6,900		6,900	15.00	103,500			103,500	122,700			122,700	14,800	137,500	-34,000	99,100	4,000	103,100
86	7,200		7,200	15.00	108,000			108,000	123,700			123,700	15,200	138,900	-30,900	72,200	2,900	75,100
87	7,500		7,500	15.00	112,500			112,500	128,000			128,000	15,600	143,600	-31,100	44,000	1,800	45,800
88	7,800		7,800	15.00	117,000			117,000	132,700			132,700	16,000	148,700	-31,700	14.100	600	14,700
89	8.200		8,200	17.11	140,300			140,300	138,500			138,500	16,500	155,000	-14,700	0	0	0
1990-2007	8,500		8,500	18.78	159,600			159,600	142,600			142,600	17,000	159,600	0	0	0	0
2008-2035	8,500		8,500	18.19	154.600			154,600	142,600			142,600	12,000	154,600	0	0	0	0

*Lump sum for turnout structure.

STATE OF CALIFORNIA
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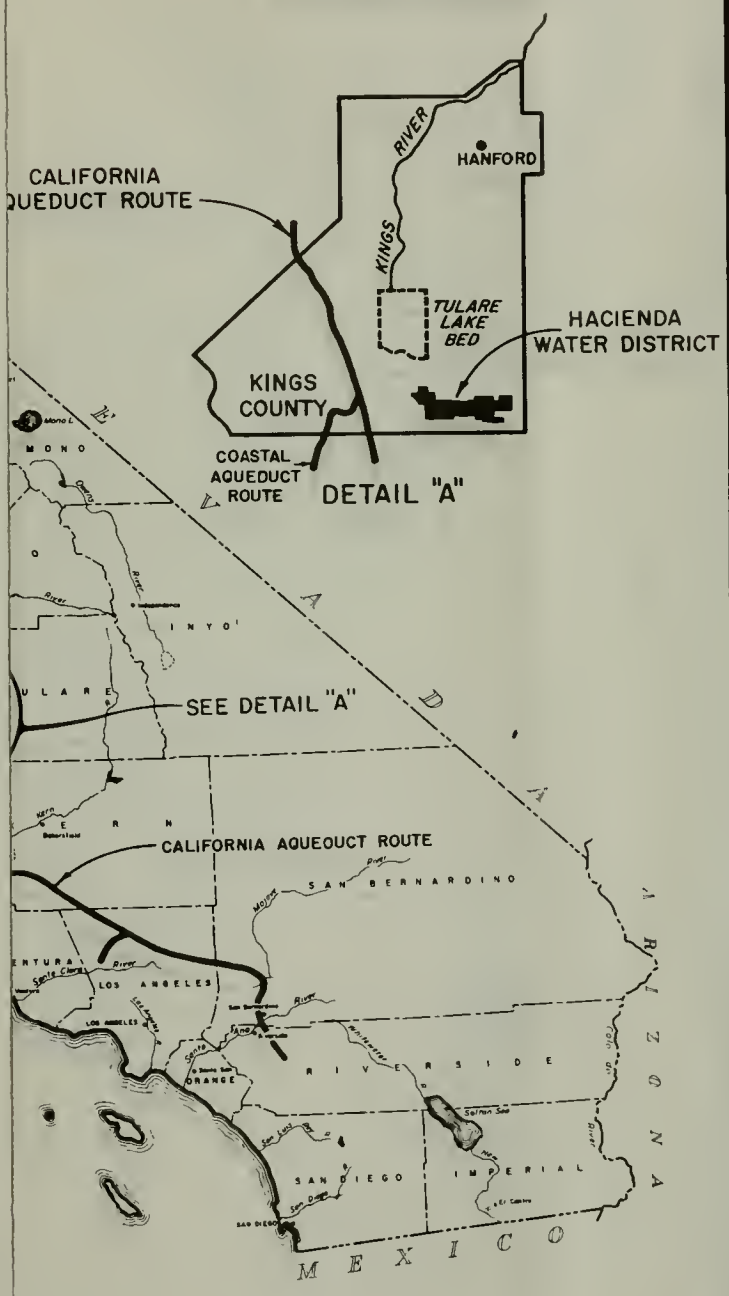
SAN JOAQUIN VALLEY BRANCH

FEASIBILITY OF SERVING THE HACIENDA WATER DISTRICT FROM THE STATE WATER PROJECT

LOCATION OF HACIENDA WATER DISTRICT

SCALE OF MILES
30 0 30 60 90



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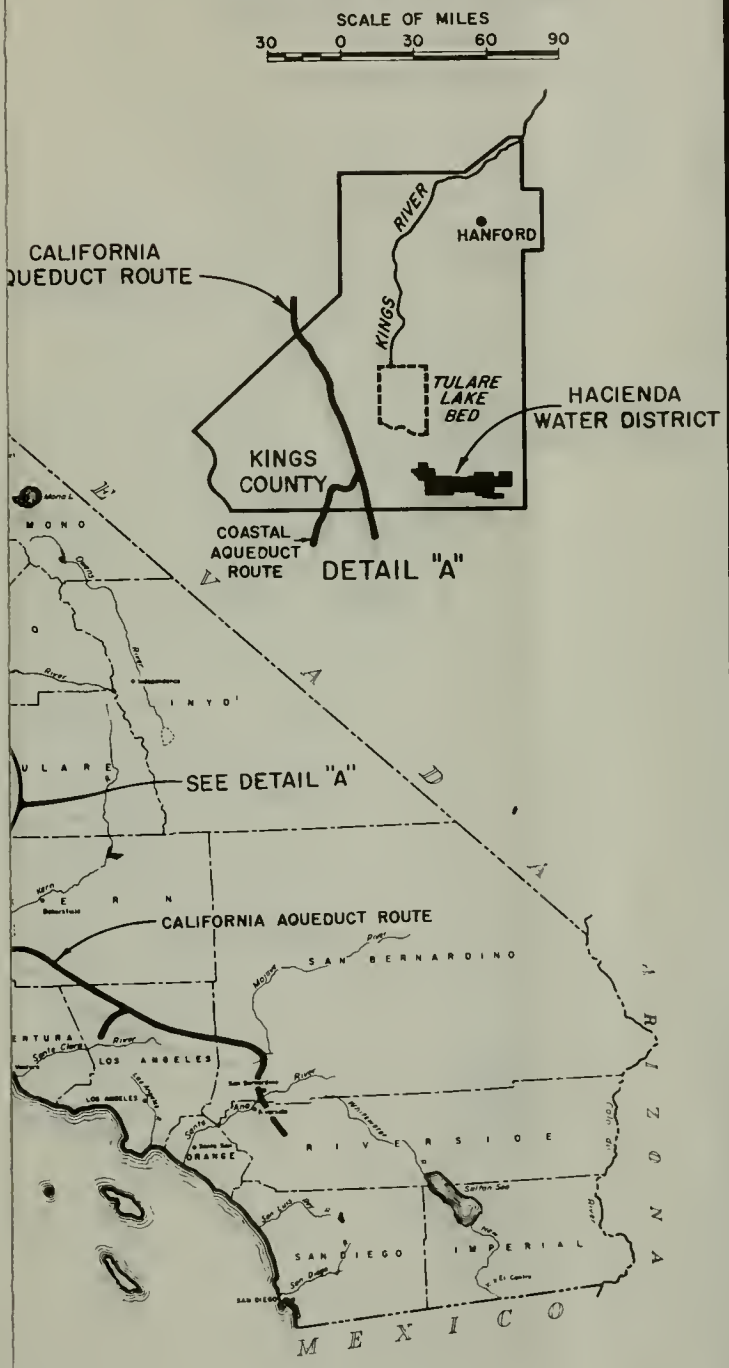

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FEASIBILITY OF SERVING THE HACIENDA WATER DISTRICT FROM THE STATE WATER PROJECT

PLATE 2.

LEGEND

HACIENDA WATER DISTRICT BOUNDARY

OVERLAPPING TULARE LAKE BASIN WATER STORAGE DISTRICT

14

T.24S.
T.25S.

STATE OF CALIFORNIA
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SAN JOAQUIN VALLEY BRANCH

FEASIBILITY OF SERVING THE HACIENDA WATER DISTRICT FROM THE STATE WATER PROJECT

HACIENDA WATER DISTRICT

1964

SCALE OF MILES

1 0 1 2

PLATE 2.

LEGEND

HACIENDA WATER DISTRICT BOUNDARY

OVERLAPPING TULARE LAKE BASIN WATER STORAGE DISTRICT

14

T. 24 S.
T. 25 S.

STATE OF CALIFORNIA
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FEASIBILITY OF SERVING THE HACIENDA WATER DISTRICT FROM THE STATE WATER PROJECT

HACIENDA WATER DISTRICT

1964

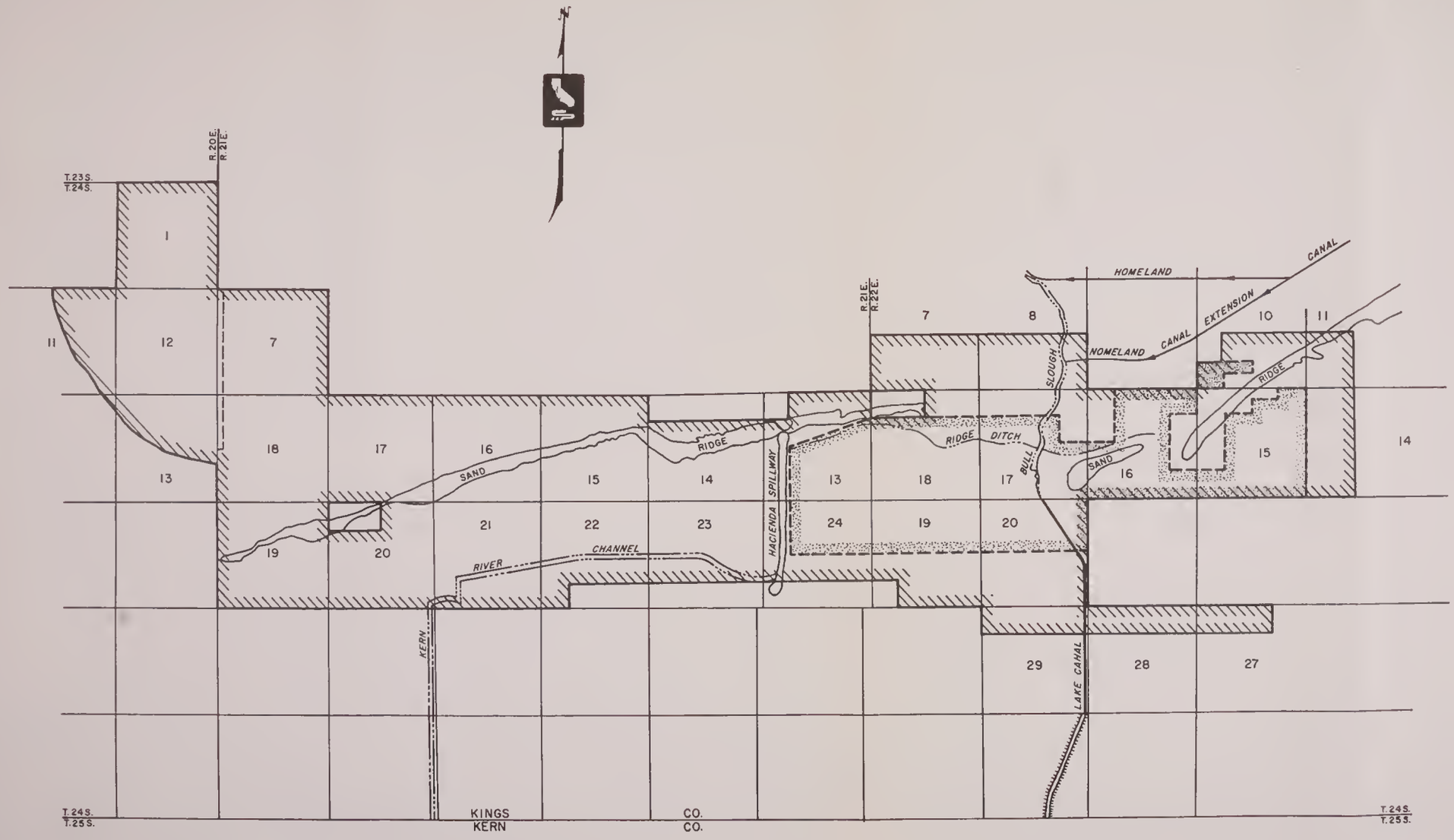
SCALE OF MILES

1 0 1 2

LEGEND

HACIENDA WATER DISTRICT BOUNDARY

OVERLAPPING TULARE LAKE BASIN WATER STORAGE DISTRICT



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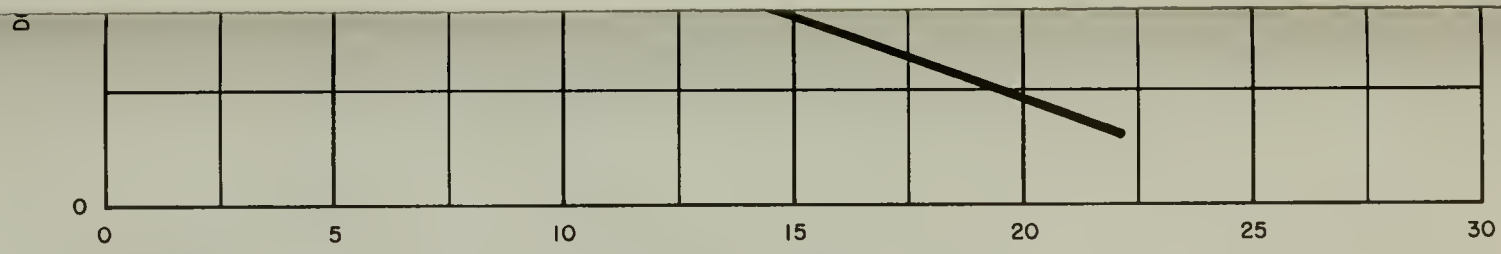
FEASIBILITY OF SERVING THE HACIENDA WATER DISTRICT FROM THE STATE WATER PROJECT

HACIENDA WATER DISTRICT
1964

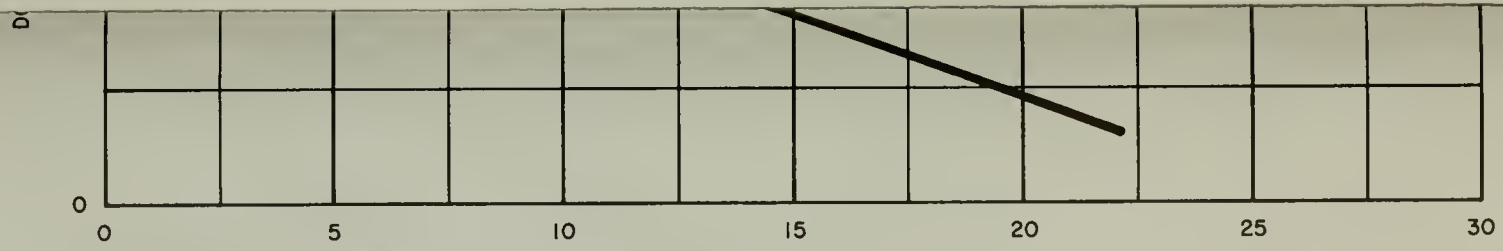
SCALE OF MILES
0 1 2



IRRIGATION WATER COST-DEMAND CURVE
FOR
HACIENDA WATER DISTRICT

PLATE 3

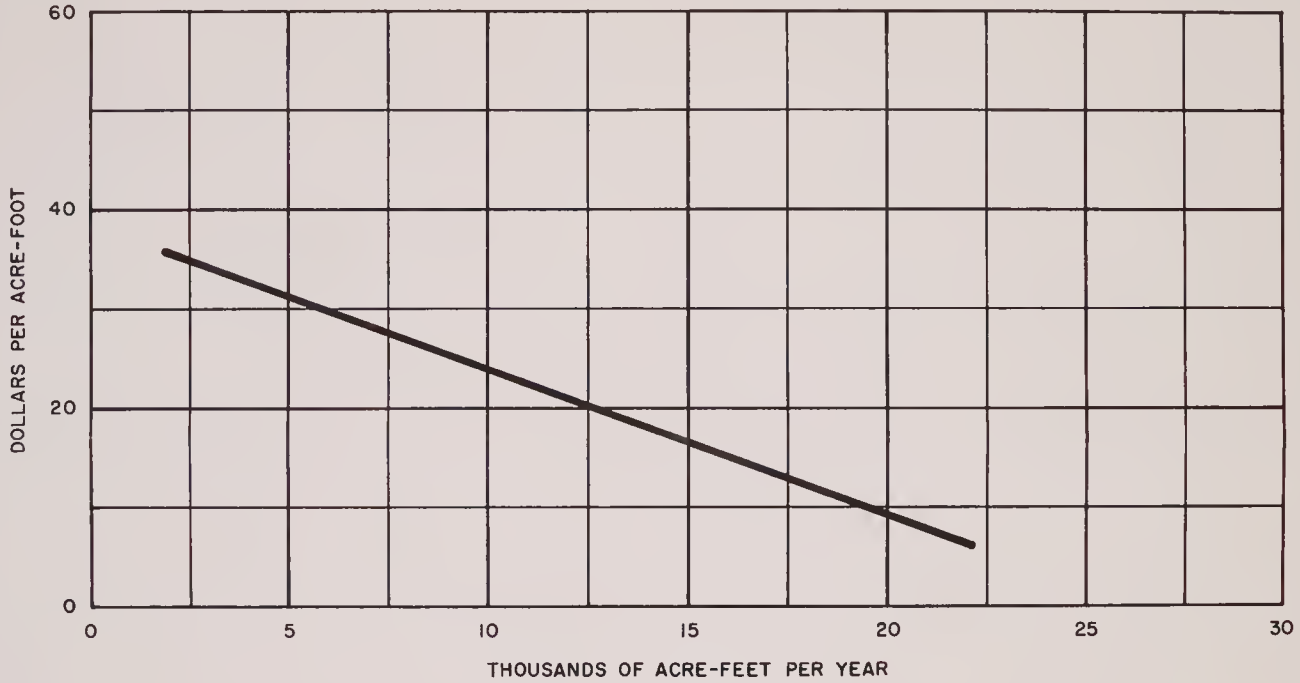
DEPARTMENT OF WATER RESOURCES SAN JOAQUIN VALLEY BRANCH 1964



IRRIGATION WATER COST-DEMAND CURVE
FOR
HACIENDA WATER DISTRICT

PLATE 3

DEPARTMENT OF WATER RESOURCES SAN JOAQUIN VALLEY BRANCH 1964



IRRIGATION WATER COST-DEMAND CURVE
FOR
HACIENDA WATER DISTRICT

PLATE 3

DEPARTMENT OF WATER RESOURCES SAN JOAQUIN VALLEY BRANCH 1964